Chapter 6

Getting to 2030: the yield question and natural resources constraints

INTRODUCTION

Given the anticipated impact of irrigated agriculture in sub-Saharan Africa outlined in Chapter 5, what are the **technical** prospects for irrigated production?

The analysis of current irrigated yields and resource utilization in the baseline (Chapter 4) now leads to a consideration of how irrigated production in sub-Saharan Africa can be expected to respond to population and income drivers by 2015 and 2030, given the existing projections for 2015 and 2030 in the AT 2015/2030 analysis. This report is also cognisant of the IFPRI Impact model scenarios for sub-Saharan Africa (Diao, *et al.*, 2003). Both approaches result is broadly similar conclusions about the expected state of agriculture in sub-Saharan Africa. However, the IFPRI sub-Saharan Africa analysis does not address the technical feasibility of productivity increases and thus the analysis is limited with respect to irrigation. The analysis below attempts to fill in this technical detail.

A REGIONAL VIEW OF YIELD GROWTH FORECASTS

Much of sub-Saharan Africa is expected to remain in deficit with respect to cereals, other food crops and, to a lesser extent, non-cereal staples. This study has shown that irrigation can have a significant role to play in addressing these deficits (especially with respect to maize, rice, wheat, animal feeds and cotton) in a region whose water and land resources remain largely unexploited.

However, two important conditions have been identified. First, much of the existing irrigation is underperforming, hence new investments must be able to overcome constraints on irrigation performance (mainly in the public sector) that have been experienced to date. Second, irrigation of staple crops on the scale necessary to address the deficits to any meaningful extent may be unaffordable without a second, higher-value crop. These considerations notwithstanding, it will be difficult to identify such high-value crops appropriate to the scales in question. Some of the production shortfalls could be made good by means of improved or increased rainfed production. However, for the sake of simplicity, the following analysis assumes a purely irrigation-based strategy. For this, it is necessary to differentiate between the relative contributions of productivity-based approaches at existing assets and production-based approaches requiring new investments.

With these issues in mind, this chapter attempts to identify the basic building blocks of an irrigation development strategy that could go beyond currently assumed plans and thereby have a positive impact on the production shortfalls still anticipated for 2030. It concentrates exclusively on cereals for two reasons: (i) the areas involved are likely to be orders of magnitude greater than those necessary for other crops that are significant sources of calorie producers; and (ii) as the analysis is based on single cropping, the same assets could be used for the irrigation of other crops in many cases. However, the analysis set out in this chapter does not address the crucial issue of the low profitability of cereal production. It is concerned with technical rather than economic or financial feasibility.

The AT 2015/2030 analysis make country-specific forecasts of yield increases for irrigated cereals that might be possible by 2015. These can be converted into weighted

TABLE 17
Weighted mean yields projected for 2015

Crop	Target (ref. Table 15)	Central	Eastern	Gulf of Guinea	Indian Ocean Islands	South Africa	Southern	Sudano-Sahelian
	(tonnes/ha)							
Barley	4.25	n.a.	2.50	n.a.	n.a.	3.00	**2.60**	n.a.
Maize	7.50	3.50	**2.79**	**3.28**	n.a.	7.50	**2.86**	**1.76**
Millet	3.75	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	**2.70**
Other cereals	2.50	1.75	1.75	1.75	n.a.	1.75	1.75	1.75
Rice	4.00	**2.73**	**3.69**	**1.19**	3.32	n.a.	**3.02**	**4.05**
Sorghum	1.20	n.a.	**2.56**	2.00	n.a.	n.a.	2.00	**1.95**
Wheat	5.00	3.00	3.50	**4.16**	n.a.	4.00	**6.50**	**2.21**

Notes:
1. Values in bold type derived from the forecasts contained in the 2015/30 analysis.
2. Values in normal type are assumptions made for the purpose of this analysis and based on technical consensus post the original AT 2015/30 analysis.
3. "n.a." refers to crops for which any irrigated production is likely to be insignificant or that are generally incompatible with local farming systems or conditions.

mean forecast yields by crop and by region as shown in Table 17. Values in bold type have been derived from the forecasts contained in the AT 2015/30 analysis while those in normal type are more conservative assumptions made for the purpose of this analysis. The term "n.a." refers to crops for which any irrigated production is likely to be insignificant or that are generally incompatible with local farming systems or conditions. Shortfalls in such crops will either have to be made good by increased rainfed production or by imports. Possibilities for importing from other sub-Saharan Africa regions are explored later in this chapter.

Using these weighted mean future yields, it is possible to estimate the increases in irrigated areas by region that will be necessary beyond those already assumed and to compare these with areas currently under agricultural water management (including irrigation). However, Table 17 shows that the 2015 projected yields are in most cases still significantly less than the target yields assumed in Table 5. Accordingly, the same analysis can be undertaken for additional yield increments, thereby providing an indication of the impact that a productivity-based approach may have on the ultimate investment needs. Therefore, Tables 19–21 consider three scenarios. First, scenario 1 (baseline) in which there are no further yield increases between 2015 and 2030 (Table 18); second, scenario 2, in which gaps between 2015 weighted mean yields and targets reduced by 50 percent between 2015 and 2030 (Table 19); third, scenario 3, in which target yields are achieved throughout by 2030 (Table 20).

The savings in necessary regional increases in irrigated cereal areas associated with Scenarios 2 and 3 are then presented in Table 21. Clearly the scope for irrigated yields to obviate an increse in irrigated areas is significant for some regions.

The results can then be compared with the unused land and water potential (Annex 4) as a first step towards the definition of any irrigation development strategy. This is done at a regional level rather than at a national level to reflect the possibility of some localized cross-border trading, while also addressing national food security based on regional self-sufficiency.

The desirability of a productivity-based approach on existing assets is clearly demonstrated. This is especially so given that such an approach would also increase production on existing assets, further reducing the need for new investments. However, the relative lack of existing assets in Central, Eastern, Gulf of Guinea and the Indian Ocean Islands regions means that purely productivity-based approaches will have more limited impact.

TABLE 18
Scenario 1 – no further yield increases between 2015 and 2030

	Central	Eastern	Gulf of Guinea	Indian Ocean Islands	South Africa	Southern	Sudano-Sahelian	Total SSA
Projected regional and sub-Saharan Africa cereal surpluses and deficits by 2030 (tonnes)								
Barley	-380 700	-270 300	-253 500	-48 400	-300 000	-71 800	-130 300	-1 455 000
Maize	-1 475 900	-1 749 000	-268 000	-339 600	1 000 000	-1 926 800	-830 000	-5 589 300
Millet	-200	-2 400	7 100	-300	0	300	-70 000	-65 500
Other cereals	-16 500	-33 200	-56 200	-14 500	-10 800	-79 900	-174 300	-385 400
Rice	-2 329 100	-1 212 900	-7 848 200	-912 400	-1 078 000	-400 200	-4 233 900	-18 014 700
Sorghum	-76 900	-126 400	0	-3 000	2 800	-40 400	-85 000	-328 900
Wheat	-4 373 200	-3 646 700	-6 249 900	-664 500	-500 000	-1 388 700	-4 311 700	-21 134 700
Yields (from Table 18)								
Barley	n.a.	2.50	n.a.	n.a.	3.00	2.60	n.a.	
Maize	3.50	3.20	3.28	n.a.	7.50	2.86	2.01	
Millet	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2.70	
Other cereals	1.75	1.75	1.75	n.a.	1.75	1.75	1.75	
Rice	3.70	3.73	3.58	3.32	n.a.	3.11	4.16	
Sorghum	n.a.	1.83	2.00	n.a.	n.a.	2.00	2.05	
Wheat	3.00	3.50	3.97	n.a.	4.00	6.54	2.21	
Irrigated areas necessary to achieve regional self-sufficiency (gaps indicated a need for a rainfed- or import-based strategy) (ha)								
Barley		108 120			100 000	27 615		
Maize	421 686	546 676	81 811		-133 333	673 108	412 270	
Millet							25 926	
Other cereals	9 429	18 971	32 114		6 171	45 657	99 600	
Rice	629 775	324 994	2 193 785	274 883		128 527	1 016 692	
Sorghum		68 945	0			20 200	41 437	
Wheat	1 457 733	1 041 914	1 573 642		125 000	212 340	1 949 899	
	2 518 623	2 109 621	3 881 352	274 883	97 838	1 107 448	3 545 824	
Area currently irrigated (from AQUASTAT) (ha)								
	111 272	611 271	470 260	1 120 133	1 498 000	562 633	2 642 147	
Ratio of necessary to current area	22.63	3.45	8.25	0.25	0.07	1.97	1.34	

TABLE 19
Scenario 2 – yield gaps between 2015 and targets reduced by 50 percent between 2015 and 2030

	Central	Eastern	Gulf of Guinea	Indian Ocean Islands	South Africa	Southern	Sudano-Sahelian	Total SSA
Projected regional and sub-Saharan Africa cereal surpluses and deficits by 2030 (tonnes)								
Barley	-380 700	-270 300	-253 500	-48 400	-300 000	-71 800	-130 300	-1 455 000
Maize	-1 475 900	-1 749 000	-268 000	-339 600	1 000 000	-1 926 800	-830 000	-5 589 300
Millet	-200	-2 400	7 100	-300	0	300	-70 000	-65 500
Other cereals	-16 500	-33 200	-56 200	-14 500	-10 800	-79 900	-174 300	-385 400
Rice	-2 329 100	-1 212 900	-7 848 200	-912 400	-1 078 000	-400 200	-4 233 900	-18 014 700
Sorghum	-76 900	-126 400	0	-3 000	2 800	-40 400	-85 000	-328 900
Wheat	-4 373 200	-3 646 700	-6 249 900	-664 500	-500 000	-1 388 700	-4 311 700	-21 134 700
Yield gaps between 2015 and targets reduced by 50% between 2015 and 2030								
Barley	n.a.	3.38	n.a.	n.a.	3.63	3.43	n.a.	
Maize	5.50	5.35	5.39	n.a.	7.50	5.18	4.76	
Millet	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.23	
Other cereals	2.13	2.13	2.13	n.a.	2.13	2.13	2.13	
Rice	3.85	3.87	3.79	3.66	n.a.	3.56	4.16	
Sorghum	n.a.	1.83	2.00	n.a.	n.a.	2.00	2.05	
Wheat	4.00	4.25	4.49	n.a.	4.50	6.54	3.61	
Irrigated areas necessary to achieve regional self-sufficiency (gaps indicated a need for a rainfed- or import-based strategy) (ha)								
Barley		80 089			82 759	20 964		
Maize	268 345	326 936	49 741		-133 333	37 1878	174 494	
Millet							21 705	
Other cereals	7 765	15 624	26 447		5 082	37 600	82 024	
Rice	605 094	313 732	2 071 456	249 316		112 515	1 016 692	
Sorghum		68 945	0			20 200	41 437	
Wheat	1 093 300	858 047	1 393 261		111 111	212 340	1 195 827	
	1 974 504	1 663 373	3 540 905	249 316	65 619	775 496	2 532 179	
Area currently irrigated (from AQUASTAT) (ha)								
	111 272	611 271	470 260	1 120 133	1 498 000	562 633	2 642 147	
Ratio of necessary to current area	17.74	2.72	7.53	0.22	0.04	1.38	0.96	

TABLE 20
Scenario 3 – target yields achieved throughout by 2030

	Central	Eastern	Gulf of Guinea	Indian Ocean Islands	South Africa	Southern	Sudano-Sahelian	Total SSA
Projected regional and sub-Saharan Africa cereal surpluses and deficits by 2030 (tonnes)								
Barley	-380 700	-270 300	-253 500	-48 400	-300 000	-71 800	-130 300	-1 455 000
Maize	-1 475 900	-1 749 000	-268 000	-339 600	1 000 000	-1 926 800	-830 000	-5 589 300
Millet	-200	-2 400	7 100	-300	0	300	-70 000	-65 500
Other cereals	-16 500	-33 200	-56 200	-14 500	-10 800	-79 900	-174 300	-385 400
Rice	-2 329 100	-1 212 900	-7 848 200	-912 400	-1 078 000	-400 200	-4 233 900	-18 014 700
Sorghum	-76 900	-126 400	0	-3 000	2 800	-40 400	-85 000	-328 900
Wheat	-4 373 200	-3 646 700	-6 249 900	-664 500	-500 000	-1 388 700	-4 311 700	-21 134 700
Yield gaps between 2015 and targets reduced by 50% between 2015 and 2030								
Barley	n.a.	4.25	n.a.	n.a.	4.25	4.25	n.a.	
Maize	7.50	7.50	7.50	n.a.	7.50	7.50	7.50	
Millet	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.75	
Other cereals	2.50	2.50	2.50	n.a.	2.50	2.50	2.50	
Rice	4.00	4.00	4.00	4.00	n.a.	4.00	4.00	
Sorghum	n.a.	1.20	1.20	n.a.	n.a.	1.20	1.20	
Wheat	5.00	5.00	5.00	n.a.	5.00	5.00	5.00	
Irrigated areas necessary to achieve regional self-sufficiency (gaps indicated a need for a rainfed- or import-based strategy) (ha)								
Barley		63 600			70 588	16 894		
Maize	196 787	233 200	35 733		-133 333	256 907	110 667	
Millet							18 667	
Other cereals	6 600	13 280	22 480		4 320	31 960	69 720	
Rice	582 275	303 225	1 962 050	228 100		100 050	1 058 475	
Sorghum		105 333	0			33 667	70 833	
Wheat	874 640	729 340	1 249 980		100 000	277 740	862 340	
	1 660 302	1 447 978	3 270 243	228 100	41 575	717 217	2 190 702	
Area currently irrigated (from AQUASTAT) (ha)								
	111 272	611 271	470 260	1 120 133	1 498 000	562 633		2 642 147
Ratio of necessary to current area	14.92	2.37	6.95	0.2	0.03	1.27		0.83

TABLE 21
Savings in additional irrigated areas afforded by achieving weighted mean yield targets

Scenario	Central	Eastern	Gulf of Guinea	Indian Ocean Islands	South Africa	Southern	Sudano-Sahelian
	(%)						
2	25	24	5	9	33	30	29
3	39	33	6	17	58	36	40

Up to this point, this analysis has been limited to an estimation of the increase in irrigated yields necessary to achieve regional cereal self-sufficiency under three yield scenarios. As such, it has ignored those cereals that are inappropriate for the farming systems or conditions in a particular region. It is now necessary to consider the additional irrigated-area increases in the regions where it may be appropriate to irrigate these crops. Therefore, Tables 22–24 rework Tables 18–20 such that, with the exception of Indian Ocean Islands region (which is difficult to analyse as it is spread all around continental Africa and in certain cases, i.e. Mauritius and Seychelles, can be assumed to have mature and sustainable trade relationships beyond Africa), shortfalls with respect to an "inappropriate" crop in a particular region are met by increased irrigation production in the closest region where the crop might be irrigated. Thus, for the sake of this analysis (which is synoptic only), the barley needs of the Central, Gulf of Guinea and Sudano-Sahelian regions could be met by increased irrigated production in the Eastern region; millet needs for sub-Saharan Africa could be met from the Sudano-Sahelian Subregion; rice needs in South Africa could be met from the Southern Subregion; and the sorghum needs of the Central Subregion could be met from the Eastern Subregion. These opportunities are indicated in Tables 22–24 where blank cells indicate countries where the crop would be appropriate for irrigation. Cells with values identify the regions, which in addition to filling the indicated gap, could potentially meet demand in the other regions as indicated by the yellow shading.

NATURAL RESOURCES CONSTRAINTS

Are there are enough land and water resources to support the production hypotheses set out above? Considering that gains accruing to a productivity-based strategy are more pronounced between Scenarios 1 and 2, than 2 and 3, Scenario 2 is assumed as the most likely scenarios against which the resource availability can be checked.

The availability of land and water resources at the regional level were considered during execution of the first subcomponent of this study. Data for this were taken from FAO (2005a), which includes estimates of the annually renewable water resources for each country and estimates of irrigation water requirements based on generic farming systems. Table 25 compares the results with the necessary area increments.

With one exception, the land and water resources of sub-Saharan Africa are considerably more than adequate for an irrigation-based strategy targeted at regional calorific self-sufficiency. Further, where regional self-sufficiency is not possible, shortfalls can be made good by exports from elsewhere in sub-Saharan Africa. So far, the analysis has assumed that the Sudano-Sahelian could be an exporting region. However, Table 25 shows that there is insufficient land. This means that the region will be among the net importers. However, given its proximity to the Mediterranean basin and its links with the North American supply chain, it is beyond the scope of this study at this stage to say whether or not it is better for it to import from elsewhere in sub-Saharan Africa or further afield.

TABLE 22
Sub-Saharan Africa cereal self-sufficiency under Scenario 1 – no further yield increases between 2015 and 2030

	Central	Eastern	Gulf of Guinea	Indian Ocean Islands	South Africa	Southern	Sudano-Sahelian	Total SSA
Projected regional and sub-Saharan Africa cereal surpluses and deficits by 2030 (tonnes)								
Barley		-1 034 800		-48 400	-300 000	-71 800		-1 455 000
Maize	-1 475 900	-1 749 000	-268 000	-339 600	1 000 000	-1 926 800	-830 000	-5 589 300
Millet							-65500	-65 500
Other cereals	-16 500	-33 200	-56 200	-14500	-10 800	-79 900	-174 300	-385 400
Rice	-2 329 100	-1 212 900	-7 848 200	-912 400		-1 478 200	-4 233 900	-18 014 700
Sorghum		-203 300	0	-3 000	2 800	-40 400	-85 000	-328 900
Wheat	-4 373 200	-3 646 700	-6 249 900	-664 500	-500 000	-1 388 700	-4 311 700	-21 134 700
Yields (from Table 18)								
Barley	n.a.	2.50	n.a.	n.a.	3.00	2.60	n.a.	
Maize	3.50	3.20	3.28	n.a.	7.50	2.86	2.01	
Millet	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2.70	
Other cereals	1.75	1.75	1.75	n.a.	1.75	1.75	1.75	
Rice	3.70	3.73	3.58	3.32	n.a.	3.11	4.16	
Sorghum	n.a.	1.83	2.00	n.a.	n.a.	2.00	2.05	
Wheat	3.00	3.50	3.97	n.a.	4.00	6.54	2.21	
Irrigated areas necessary to achieve regional self-sufficiency (gaps indicated a need for a rainfed- or import-based strategy) (ha)								
Barley		413 920			100 000	27 615		
Maize	421 686	546 676	81 811		-133 333	673 108	412 270	
Millet							24 259	
Other cereals	9 429	18 971	32 114		6 171	45 657	99 600	
Rice	629 775	324 994	2 193 785	274 883		474 736	1 016 692	
Sorghum		110 891	0			20 200	41 437	
Wheat	1 457 733	1 041 914	1 573 642		125 000	212 340	1 949 899	
	2 518 623	2 457 366	3 881 352	274 883	97 838	1 453 656	3 544 157	
Change		yes				yes	yes	
Area currently Irrigated (from AQUASTAT) (ha)								
	111 272	611 271	470 260	1 120 133	1 498 000	562 633	2 642 147	
Ratio of necessary to current area	22.63	4.02	8.25	0.25	0.07	2.58	1.34	

TABLE 23
Sub-Saharan Africa cereal self-sufficiency under Scenario 2 – yield gaps between 2015 and targets reduced by 50 percent between 2015 and 2030

	Central	Eastern	Gulf of Guinea	Indian Ocean Islands	South Africa	Southern	Sudano-Sahelian	Total SSA
Projected regional and sub-Saharan Africa cereal surpluses and deficits by 2030 (tonnes)								
Barley		-1 034 800		-48 400	-300 000	-71 800		-1 455 000
Maize	-1 475 900	-1 749 000	-268 000	-339 600	1 000 000	-1 926 800	-830 000	-5 589 300
Millet							-65 500	-65 500
Other cereals	-16 500	-33 200	-56 200	-14 500	-10 800	-79 900	-174 300	-385 400
Rice	-2 329 100	-1 212 900	-7 848 200	-912 400		-1 478 200	-4 233 900	-18 014 700
Sorghum		-203 300		-3 000	2 800	-40 400	-85 000	-328 900
Wheat	-4 373 200	-3 646 700	-6 249 900	-664 500	-500 000	-1 388 700	-4 311 700	-21 134 700
Yield gaps between 2015 and targets reduced by 50% between 2015 and 2030								
Barley	n.a.	3.38	n.a.	n.a.	3.63	3.43	n.a.	
Maize	5.50	5.35	5.39	n.a.	7.50	5.18	4.76	
Millet	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.23	
Other cereals	2.13	2.13	2.13	n.a.	2.13	2.13	2.13	
Rice	3.85	3.87	3.79	3.66	n.a.	3.56	4.16	
Sorghum	n.a.	1.83	2.00	n.a.	n.a.	2.00	2.05	
Wheat	4.00	4.25	4.49	n.a.	4.50	6.54	3.61	
Irrigated areas necessary to achieve regional self-sufficiency (gaps indicated a need for a rainfed- or import-based strategy) (ha)								
Barley		306 607			82 759	20 964		
Maize	268 345	326 936	49 741		-133 333	371 878	174 494	
Millet							20 310	
Other cereals	7 765	15 624	26 447		5 082	37 600	82 024	
Rice	605 094	313 732	2 071 456	249 316		415 590	1 016 692	
Sorghum		110 891	0			20 200	41 437	
Wheat	1 093 300	858 047	1 393 261		111 111	212 340	1 195 827	
	1 974 504	1 931 837	3 540 905	249 316	65 619	1 078 572	2 530 783	
Change		yes				yes	yes	
Area currently irrigated (from AQUASTAT) (ha)								
	111 272	611 271	470 260	1 120 133	1 498 000	562 633		2 642 147
Ratio of necessary to current area	17.74	3.16	7.53	0.22	0.04	1.92	0.96	

TABLE 24
Sub-Saharan Africa cereal self-sufficiency under Scenario 3 – target yields achieved throughout by 2030

	Central	Eastern	Gulf of Guinea	Indian Ocean Islands	South Africa	Southern	Sudano-Sahelian	Total SSA
Projected regional and sub-Saharan Africa cereal surpluses and deficits by 2030 (tonnes)								
Barley		-1 034 800		-48 400	-300 000	-71 800		-1 455 000
Maize	-1 475 900	-1 749 000	-268 000	-339 600	1 000 000	-1 926 800	-830 000	-5 589 300
Millet							-65 500	-65 500
Other cereals	-16 500	-33 200	-56 200	-14 500	-10 800	-79 900	-174 300	-385 400
Rice	-2 329 100	-1 212 900	-7 848 200	-912 400		-1 478 200	-4 233 900	-18 014 700
Sorghum		-203 300		-3 000	2 800	-40 400	-85 000	-328 900
Wheat	-4 373 200	-3 646 700	-6 249 900	-664 500	-500 000	-1 388 700	-4 311 700	-21 134 700
Yield gaps between 2015 and targets reduced by 50% between 2015 and 2030								
Barley	n.a.	4.25	n.a.	n.a.	4.25	4.25	n.a.	
Maize	7.50	7.50	7.50	n.a.	7.50	7.50	7.50	
Millet	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.75	
Other cereals	2.50	2.50	2.50	n.a.	2.50	2.50	2.50	
Rice	4.00	4.00	4.00	4.00	n.a.	4.00	4.00	
Sorghum	n.a.	1.20	1.20	n.a.	n.a.	1.20	1.20	
Wheat	5.00	5.00	5.00	n.a.	5.00	5.00	5.00	
Irrigated areas necessary to achieve regional self-sufficiency (gaps indicated a need for a rainfed- or import-based strategy) (ha)								
Barley		243 482			70 588	16 894		
Maize	196 787	233 200	35 733		-133 333	256 907	110 667	
Millet							17 467	
Other cereals	6 600	13 280	22 480		4 320	31 960	69 720	
Rice	582 275	303 225	1 962 050	228 100		369 550	1 058 475	
Sorghum		169 417	0			33 667	70 833	
Wheat	874 640	729 340	1 249 980		100 000	277 740	862 340	
	1 660 302	1 691 944	3 270 243	228 100	41 575	986 717	2 189 502	
Change		yes				yes	yes	
Area currently irrigated (from AQUASTAT) (ha)								
	111 272	611 271	470 260	1 120 133	1 498 000	562 633	2 642 147	
Ratio of necessary to current area	14.92	2.77	6.95	0.20	0.03	1.75	0.83	

TABLE 25
Comparison of Scenario 2 land and water demands with the available resources for sub-Saharan Africa self-sufficiency

Region	Land area			Water			
	Needed	Available	Sufficient?	Needed		Annually renewable	Sufficient?
	(ha)	(ha)		(m^3/ha/year)	(km^3/year)	(km^3/year)	
Central	1 974 504	13 588 728	Yes	14 540	28.71	21 876	Yes
Eastern	1 663 373	5 093 094	Yes	13 990	23.27	281	Yes
Gulf of Guinea	3 540 905	6 923 156	Yes	18 073	63.99	952	Yes
Indian Ocean Islands	249 316	417 881	Yes	15 355	3.83	340	Yes
Southern	1 078 572	3 937 628	Yes	13 961	15.06	270	Yes
Sudano-Sahelian	2 530 783	1 146 400	No	15 360	38.87	160	Yes